CSc Practical Worksheet

A'S
Paper 1

Topic: Assembly Language

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1. The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction			Explanation
Op code (mnemonic)	**Operand**	**Op code (binary)**	
LDM	#n	1100 0001	Immediate addressing. Load number n to ACC.
LDD	<address>	1100 0010	Direct addressing. Load the contents of the given address to ACC.
LDV	#n	1100 0011	Relative addressing. Move to the address n locations from the address of the current instruction. Load the contents of this address to ACC.
STO	<address>	1100 0100	Store the contents of ACC at the given address.
DEC		1100 0101	Decrement the contents of ACC.
OUTCH		1100 0111	Output the character corresponding to the ASCII character code in ACC.
JNE	<address>	1110 0110	Following a compare instruction, jump to <address> if the compare was False.
JMP	<address>	1110 0011	(Unconditionally) jump to the given address.
CMP	#n	1110 0100	Compare the contents of ACC with number n.

Complete the trace table for the following assembly language program.

Label	*Instruction*	
StartProg:	LDV	#CountDown
	CMP	Num1
	JNE	CarryOn
	JMP	Finish
CarryOn:	OUTCH	
	LDD	CountDown
	DEC	
	STO	CountDown
	JMP	StartProg
Finish:	LDM	#88
	OUTCH	
	END	
CountDown:	15	
	32	
	51	
	67	
Num1:	32	

ASCII code table (selected codes only)				
<Space>	3	B	C	X
32	51	66	67	88

ACC	CountDown	OUTPUT
	15	
67		C
15		

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2. The following table shows part of the instruction set for a processor. The processor has one general purpose register, the Accumulator (ACC), and an Index Register (IX).

Instruction			Explanation
Op code (mnemonic)	**Operand**	**Op code (binary)**	
LDD	<address>	0001 0011	Direct addressing. Load the contents of the location at the given address to the Accumulator (ACC).
LDI	<address>	0001 0100	Indirect addressing. The address to be used is at the given address. Load the contents of this second address to ACC.
LDX	<address>	0001 0101	Indexed addressing. Form the address from <address> + the contents of the Index Register. Copy the contents of this calculated address to ACC.
LDM	#n	0001 0010	Immediate addressing. Load the denary number n to ACC.
LDR	#n	0001 0110	Immediate addressing. Load denary number n to the Index Register (IX).
STO	<address>	0000 0111	Store the contents of ACC at the given address.

The following diagram shows the contents of a section of main memory and the Index Register (IX).

(a) Show the contents of the Accumulator (ACC) after each instruction is executed.

IX

0	0	0	0	0	1	1	0

Address	Main memory contents
350	
351	86
352	
353	
354	
355	351
356	
357	22
358	

(i) LDD 355

ACC ..... [1]

(ii) LDM #355

ACC ..... [1]

(iii) LDX 351

ACC ..... [1]

(iv) LDI 355

ACC ..... [1]

(b) Each machine code instruction is encoded as 16 bits (8-bit op code followed by an 8-bit operand).

Write the machine code for these instructions:

LDM #67

LDX #7

(c) Computer scientists often write binary representations in hexadecimal.

(i) Write the hexadecimal representation for the following instruction.

0	0	0	1	0	1	0	0	0	1	0	1	1	1	1	0

.....

(ii) A second instruction has been written in hexadecimal as:

16 4D

Write the assembly language for this instruction with the operand in denary.

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